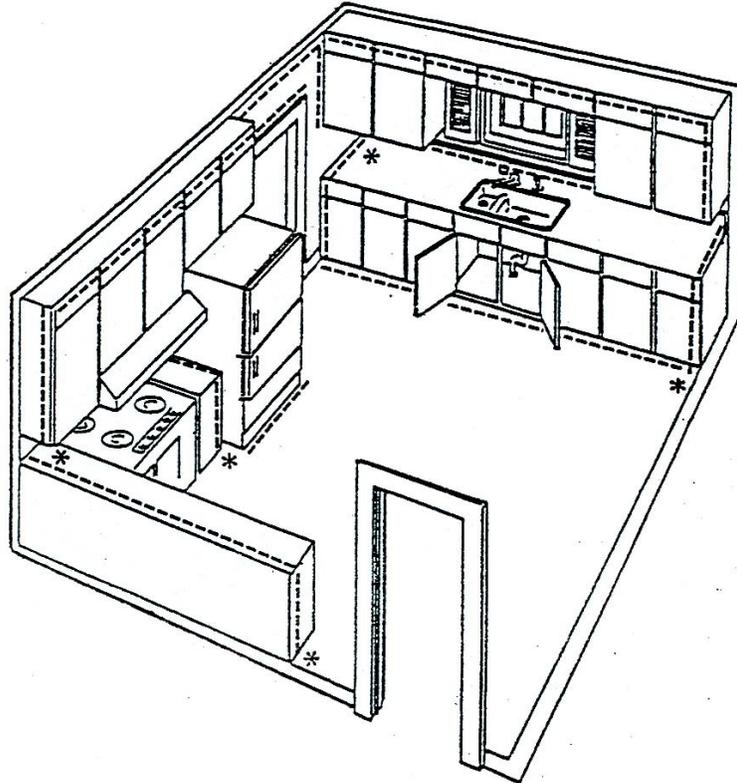


EFFECTIVE MANAGEMENT OF COCKROACH INFESTATIONS



County of Los Angeles · Department of Public Health

Vector Management Program

5050 Commerce Drive

Baldwin Park, CA 91706

(626) 430-5450

The four species of cockroaches in Los Angeles County that can become common pests are the German cockroach, brown-banded cockroach, oriental cockroach, and the American cockroach. Of these four species, the German cockroach has the greatest potential for becoming persistent and troublesome, followed by the brown-banded cockroach, both of which prefer indoor locations. Oriental and American cockroaches occasionally pose problems in moist, humid areas.

PROBLEMS ASSOCIATED WITH COCKROACHES

Cockroaches may become pests in homes, schools, restaurants, hospitals, warehouses, offices, and virtually in any structure that has food preparation or storage areas. They contaminate food and eating utensils, occasionally damage fabric and paper products, leave stains on surfaces, and produce unpleasant odors when present in high enough numbers.

When cockroaches that live outdoors come into contact with human excrement in sewers or with pet droppings, they have the potential to transmit bacteria that cause food poisoning (*Salmonella* spp. and *Shigella* spp.) if they enter into structures. German cockroaches are believed to be capable of transmitting disease-causing organisms such as *Staphylococcus* spp., *Streptococcus* spp., hepatitis virus, and coliform bacteria. They also have been implicated in the spread of typhoid and dysentery. Indoor infestations of cockroaches are an important source of allergens and risk for asthma among some populations. The levels of cockroaches and allergens have been directly related to cockroach density, housing disrepair, and sanitary conditions.

IDENTIFICATION

Cockroaches are medium-sized to large insects that have broad, flattened bodies with long antennae and a prominent, shield-shaped section behind the head. Some people confuse them with beetles, but adult cockroaches have membranous wings and lack the thick, hardened forewings of beetles. They are nocturnal and have a tendency to scatter when disturbed. Immature cockroaches, known as nymphs, look like adults, but are smaller and do not have wings.

Of the four common pest species, German and brown-banded cockroaches inhabit buildings, whereas the oriental and American cockroaches usually live outdoors or in masonry enclosures away from buildings, only occasionally invading structures. It is important to correctly identify the species involved in a cockroach infestation so that the most effective control methods may be chosen.

German Cockroach

The German cockroach, *Blattella germanica*, is the most common indoor species, especially in multiple-family dwellings. They prefer food preparation areas, kitchens, and bathrooms because they favor warm, humid areas that are close to food and water. In severe infestations they may spread to other parts of the structure. In heavily infested households, the German cockroach may be found in every part of the structure and clusters of them may be visible during the day. Generally, for every cockroach seen in the daytime there are many more concealed in dark, protected locations. This cockroach exhibits grouping behavior, and because they develop from egg to adult by a gradual change in size and form, all developmental stages can be found together in preferred harborages.

This species reproduces more rapidly than the other common pest cockroaches. A single female and her offspring can produce over 30,000 individuals in a year when conditions are ideal, but many may succumb to cannibalism and other population pressures. The female is often observed carrying around a light tan egg case (ootheca), about 1/4 inch long, at the tip of her abdomen. She will usually drop it about 2 days before it hatches, but sometimes the egg case hatches while it is still being carried by the female. Each egg case contains about 30 young, and a female may produce a new egg case every few weeks. Recent research suggests the female cockroach remains in a secluded harborage and does not venture out for either food or water during the period that she carries the ootheca. This behavior stresses the importance of locating and addressing all harborage sites when attempting to manage an infestation.

Brownbanded Cockroach

The brownbanded cockroach, *Supella longipalpa*, is not as common as the German cockroach in California and accounts for only about 1% of all indoor infestations. This species seeks out areas that are very warm most of the time, preferring temperatures of about 80°F, about 5° to 10°F warmer than what German cockroaches prefer. Favorite locations include near the warm electrical components of appliances such as radios, televisions, and refrigerators. Brownbanded cockroaches prefer starchy food (e.g., glue on stamps and envelopes), are often found in offices and other places where paper is stored, and are more common in apartments or homes that are not air conditioned or that are kept very warm. They also infest animal-rearing facilities, kitchens, and hospitals. Adult males sometimes fly when disturbed, but females do not fly. Females glue light brown egg cases, which are about 1/4 inch long, to ceilings, beneath furniture, or in closets or other dark places where eggs incubate for several weeks before hatching. Each female and her offspring are capable of producing over 600 cockroaches in one year.

Oriental Cockroach

The oriental cockroach, *Blatta orientalis*, is sometimes referred to as a water bug or black beetle. It lives in dark, damp places like indoor and outdoor drains, water control boxes, woodpiles, basements, garages, trash cans, and damp areas under houses when plumbing leaks or landscape watering produce a moisture problem. It is most likely to occur in single-family dwellings that are surrounded by vegetation. It is also common in ivy, ground cover, and outside locations where people feed pets. Oriental roaches prefer cooler temperatures than the other species, and populations of this cockroach often build to large numbers in masonry enclosures such as water meter boxes or beneath concrete patio slabs where soil erosion has produced a void.

At night, oriental cockroaches may migrate into buildings in search of food and are frequently found in garages. They usually remain on the ground floor of buildings and move more slowly than the other species. Oriental cockroaches do not fly and are unable to climb smooth vertical surfaces; consequently they are commonly found trapped in porcelain sinks or tubs. Females deposit dark red-brown egg cases, which are about 3/8 inch long, in debris or food located in sheltered places. Each female and her offspring can produce nearly 200 cockroaches in one year.

American Cockroach

The American cockroach, *Periplaneta americana*, prefers warm and humid environments, usually with temperatures in excess of 82°F. Under the right conditions, they readily live outdoors and are common pests in zoos and animal-rearing facilities. They are also common in underground sewer and steam tunnels, and masonry storm drains. Occasionally they forage from sewers and other areas into the ground floor of buildings. Adult females carry the egg cases around for about 6 days and then cement them to a protected surface where they incubate for about 2 months or longer. The egg cases, which are about 3/8 inch long, are brown when laid but turn black in 1 to 2 days. Each egg capsule contains about 12 young; a female and her offspring can produce over 800 cockroaches in one year.

LIFE CYCLE

An adult female cockroach produces an egg capsule, called an ootheca, which it carries around protruding from the tip of the abdomen. The German cockroach carries the ootheca for most of the 30-day incubation period and then drops it about the time the eggs hatch. The other three species carry it for only a short time before depositing it in a suitable location where it incubates for weeks or months. Young or immature cockroaches undergo gradual metamorphosis, which means they resemble adults and have similar feeding habits, but they do not have fully developed wings and are not capable of reproduction until mature. Immediately after molting, cockroaches are white, but their outer covering darkens as it hardens, usually within hours.

Cockroaches are nocturnal. They hide in dark, warm areas, especially narrow spaces where surfaces touch them on both sides. Adult German cockroaches can hide in a crack 1/16 inch or 1.6 mm wide. Immature cockroaches tend to stay in even smaller cracks where they are well protected. Cockroaches tend to congregate in corners and generally travel along the edges of walls or other surfaces.

MANAGEMENT

Managing cockroaches is not easy. You must first determine where the roaches are located. The more hiding places you locate and manage, the more successful your control program will be. Remember that cockroaches are tropical and most like warm hiding places with access to water. Some locations may be difficult to get to. Reduction of both food and water sources, as well as all hiding places is essential. Although baits are a highly effective method of control, if cockroaches have access to stored food products, if pet food is left out, or dirty dishes are left in the sink over night, this method of control will have limited effect. The cockroaches will continue to rely on those food sources and ignore the baits. It is also important to remember that insecticide sprays alone will not eliminate cockroaches. The most effective method of managing an established cockroach infestation is by applying an integrated approach that utilizes several different strategies.

Use the IPM Approach

Integrated Pest Management (IPM) is the most effective means of controlling a cockroach infestation and preventing its reoccurrence. In other words, change the situation that promotes cockroaches! All aspects of the situation must be evaluated:

- Reduce food and water sources
- Eliminate hiding places
- Consider using baits
- Avoid sprays if possible
- Use traps to monitor the population

If you know the species of cockroach, you will be better able to determine where the source of infestation is and where to place traps, baits, or insecticides. Note locations of suspected infestations and concentrate control and preventive measures in these areas. The keys to controlling cockroaches are sanitation and exclusion: cockroaches are likely to reinvade as long as a habitat is suitable to them, that is, if food, water, and shelter are available, so the conditions that promoted the infestation must be changed. In addition to sanitation and exclusion, baits can be effective against most species of cockroaches. Pesticide spray products are registered for use on cockroaches and may be used to immediately suppress populations, but they will not provide a long-term solution. Only altering the conditions that allowed the cockroaches to become established will provide a lasting solution. It is important to know that commercially available devices that emit ultrasound to repel cockroaches are not effective.

Monitoring Cockroaches

Traps offer the best way to monitor cockroach populations. By placing traps in several locations and inspecting them regularly, you can identify the areas of most severe infestation and know where to concentrate control efforts. Traps can also be very helpful in evaluating the effectiveness of control strategies. Cockroach traps available in most retail outlets such as super markets, drug stores, and hardware stores work well. These traps are open-ended and are lined inside with a sticky material.

To be effective, traps must be placed where cockroaches are likely to encounter them when foraging. The best places are at the junctions of floors and walls and close to sites where cockroaches are suspected. Good potential monitoring sites can be determined by accumulations of the evidence that cockroaches leave behind. (See locations marked with * in Figure 1.)

Common signs to watch for are fecal matter (e.g., dark spots or smears), cast skins, egg cases, and live or dead cockroaches. Place traps in all corners of the room to give you an idea where roaches are entering. In the kitchen put traps against walls behind the stove and the refrigerator and in cabinets. It is often a good idea to number the traps so you can keep records for each trap separately. Check the traps daily for several days until it is apparent which locations capture the greatest number of roaches. This will usually occur within the first 24 hours of placing a trap. Discard sticky traps by placing them in a sealed plastic bag in the trash. Keep records of roaches trapped in different locations before and after you initiate a management program to evaluate its success.

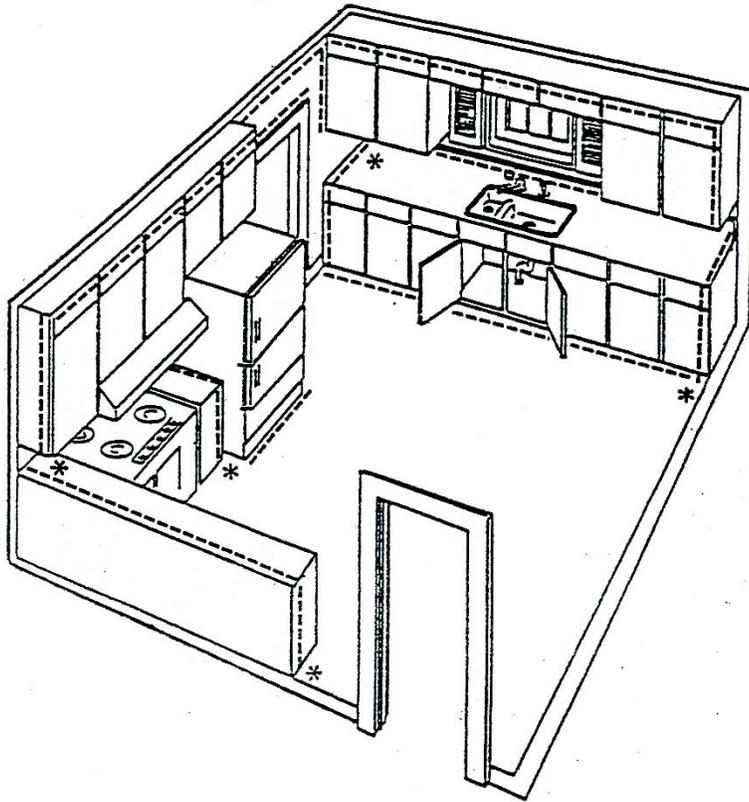


Figure 1.

Traps and baits should be located in areas where cockroaches have the greatest probability of encountering them. Cockroaches will not seek out baits or traps, they must come across them during their normal travel patterns. Place traps or baits in corners, in the back of cabinets, behind the refrigerator, adjacent to known hiding areas, and other undisturbed locations where evidence of cockroaches has been observed. Common placement sites are marked with an asterisk *.

If it is necessary to quickly reduce a well established infestation, spray applications can be made in a 2 to 4 inch wide band along areas where cockroaches are known to travel, and adjacent to known harborages. Common travel paths are marked with dotted ----- lines. Do not apply sprays to areas where traps or baits are located.

You can also track a cockroach infestation by using a flashlight to inspect cracks, underneath counters, around water heaters, and in other dark locations. Look for live and dead cockroaches, cast skins, egg capsules, and droppings, all of which aid in identification and are evidence of an infestation.

Sanitation

Cockroaches thrive where food and water are available to them. Even tiny amounts of crumbs or liquids caught between cracks provide a food source. Important sanitation measures include the following:

- Store food in insect-proof containers such as glass jars or resealable plastic containers.
- Keep garbage and trash in containers with tight-fitting lids and use liners to keep interior of cans clean. Keep trash cans away from doorways. Remove trash, newspapers, magazines, piles of paper bags, rags, boxes, and other items that provide hiding places and harborage.

- Eliminate plumbing leaks and correct other sources of free moisture. Increase ventilation where condensation is a problem.
- Vacuum cracks and crevices to remove food and debris. Be sure surfaces where food or beverages have been spilled are cleaned up immediately. Vacuuming also removes cockroaches, shed skins, and egg capsules. Removing cockroaches reduces their numbers and slows development. Vacuumed cockroaches and debris should be properly disposed of in the trash. Because small particles of cuticle and droppings that become airborne during the vacuuming process and may cause allergies, it is recommended that the vacuum cleaner have a HEPA (high efficiency particulate absorber) filter or triple filters.

Exclusion and Removal of Hiding Places

During the day cockroaches hide around water heaters, in cupboard cracks, in or behind stoves, inside crawl spaces, deep within outdoor vegetation, and many other dark locations. Limiting hiding areas or avenues of access to living areas is an essential part of an effective management strategy. False-bottom cupboards, hollow walls, and similar areas are common cockroach refuges. Prevent access to the inside of buildings through cracks, conduits, under doors, or through other structural flaws. If it is not practical to remedy these problem areas, treat them with boric acid powder insecticides formulated for cockroach control. Products available to homeowners in California are Roach Prufe and Hot Shot Maxattrax Roach Powder.

Take the following measures if observation or trapping shows roaches are migrating into a building from outdoors or other areas of the building:

- Seal cracks and other openings to the outside.
- Use weather stripping on doors and windows.
- Look for other methods of entry, such as from items being brought into the building, especially appliances, furniture, and items that were recently in storage.
- Inspect food deliveries before putting them in kitchens.
- Look for egg cases (oothecae) glued to undersides of furniture, in refrigerator and other appliance motors, boxes, and other items. Remove and destroy any that you find.
- Locate and seal cracks inside the treatment area where cockroaches can hide.
- Trim shrubbery around buildings to increase light and air circulation, especially near vents, and eliminate ivy or other dense ground covers near the house, as these may harbor cockroaches.
- From around the outside of buildings remove trash and stored items such as stacks of lumber or firewood that provide hiding places for cockroaches.
- Consider keeping a layer of gravel about 6 to 12 inches wide around the perimeter of buildings.

Chemical Control

Insecticides are most effective in controlling cockroaches when combined with sanitation and exclusion practices that limit the cockroach's ability to establish or reinvade; *chemical control alone will not solve the problem*. If insecticides are used, they must always be used with extreme care. Indoor chemical control is warranted only if the cockroach population is established, but not for an incidental intruder or two.

Baits. Bait products are the primary pesticides used to treat cockroach infestations. They can be packaged as pastes, gels, granules, or dusts. Most insecticides used in baits are slow acting. Consequently an effective bait program does not give immediate results, but may take 7 days or longer to provide visual evidence of its effects. Baits can be quite effective for long-term control of cockroaches unless the cockroaches have other food sources available to them.

Baits do not control all cockroaches equally. Female cockroaches with egg cases do very little feeding and avoid open spaces; consequently they are less likely to be immediately affected by a bait.

Bait Stations. The most popular form for home use is prefilled bait stations, which are small plastic units that contain an attractive food base along with an insecticide. Refillable bait stations are available in stores and are refilled with bait granules or gel. The advantage of bait stations is that insecticides can be confined to a small area rather than being dispersed, and they are relatively child resistant. Baits in plastic containers also remain effective for many months.

Gel Bait. For crack and crevice treatments, gel baits can be very effective. Apply gel using a bait gun or syringe in small dabs in cracks and crevices where cockroaches will find it. While they are fresh, bait gels are very effective when placed in locations where they will be found by cockroaches. To remain effective, however, the gels need to be reapplied frequently. Bait gels dehydrate in about 3 days when left in open air, it is therefore recommended that gels be used indoors only.

Baits that are available to homeowners can usually be purchased at most retail outlets that carry garden supplies. Examples include **Stapleton's Magnetic Roach Food** by Blue Diamond, **Combat** gel bait and prefilled bait stations, and **Pre-Empt Professional Cockroach Gel Bait**. These products may vary in effectiveness according to cockroach species.

As with sticky traps, insecticidal baits do not attract cockroaches so place them near hiding spaces or where roaches are likely to encounter them when foraging. If the bait stations are labeled for outdoor use, place them around building perimeters, in valve or water meter boxes, and around planters. Indoors, place bait packets under or behind appliances, along wall borders, and in cabinets. Baits can also be placed next to fecal specks and droppings of cockroaches, which contain a natural attractant or aggregation pheromone. Look for these fecal specks and droppings under kitchen counters, behind kitchen drawers, and in the back of cabinets.

Dusts. Insecticidal dusts can be an important part of an IPM program when applied in enclosed, out of the way locations where cockroaches hide. The most common active ingredient is boric acid powder. Boric acid powder is a contact poison and can be used preventively or when treating existing infestations. Boric acid powder is the least repellent of all the insecticides for cockroach control, and if it remains dry and undisturbed, it provides control for a very long time. Because it has a positive electrostatic charge, the dust clings to the body of a cockroach as it walks through a treated area and the cockroach ingests small amounts when it grooms itself. Because boric acid powder is fairly slow acting, it may take 7 days or more to have a significant effect on a cockroach population. Because of its toxicity to plants, boric acid is not recommended for outdoor use.

Blow dust into cracks and crevices or lightly spread it in areas where visible residues are not a problem and where people will not contact it. Remove kick panels on refrigerators and stoves and apply a light film of dust throughout the entire area underneath these appliances. **A very thin film of dust is more effective than a thick layer.** Holes that are the same size as the tip of a puff-type applicator can be drilled into the top of kick panels beneath cabinets and powder may be applied through the holes to these areas as well as under the sink, in the dead space between the sink and wall, and around utility pipes (See Figure 2.). Also treat along the back edges and in corners of shelves in cabinets, cupboards, pantries, and closets.

Formulated as an insecticide, boric acid dusts usually contain about 1% of an additive that prevents the powder from caking and improves dusting properties. If it gets wet and then dries and cakes, it loses its electrostatic charge and will not be picked up readily by the cockroach. If this occurs, reapply powder to these areas.

Sprays and Aerosols. Although sprays may provide a quick, temporary knockdown of cockroaches, they do not give long-term control. Sprays are often highly repellent to cockroaches and should not be applied to surfaces in areas where traps or bait stations are located. Sprays may also disperse cockroaches to other areas of the building from which they could later return. Also, cockroaches have become resistant to many insecticides that formerly controlled them.

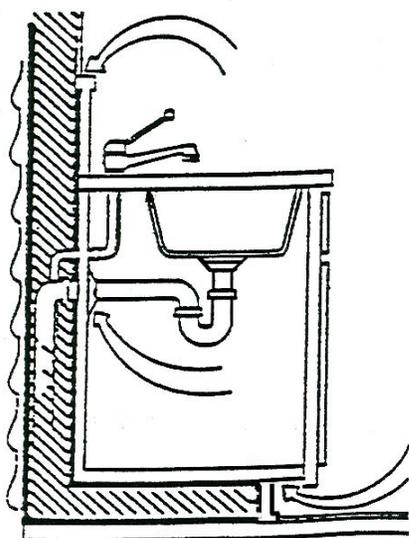


Figure 2.

Small amounts of boric acid powder may be applied with special applicators to areas under and behind stoves and refrigerators, and voids behind or beneath cabinets and countertops. Access to these areas may often be found at corners, through small cracks, and at plumbing and electrical installation openings in walls. The object of the application is to apply a thin layer to those hidden surfaces where the cockroaches travel and hide.

Sprays should not be necessary if an IPM program using sanitation, exclusion, and appropriate baits and dusts is practiced. However, in heavily infested structures, an initial application may be necessary to quickly reduce excessive numbers of the cockroaches while structural modifications are being initiated. Follow all directions on the container and carefully apply the spray to surfaces where numerous cockroaches have been observed (See dotted lines in Figure 1.). Insecticide treatment of breeding sites for oriental and American cockroaches, including inside meter boxes, under uplifted concrete or on sewer lids, or around landscape plantings may be required when populations of these species are high and moving into adjacent buildings. However, an occasional cockroach observed in these sites does not indicate a need for treatment.

Follow-Up

After a cockroach IPM program has been started, evaluate the effectiveness of the methods that are being used with regular monitoring. Use traps or visual inspections to help determine if further treatment is necessary.

If populations persist, reevaluate the situation. Look for other sources of infestations, make sure that all possible entryways are blocked, be certain that food and water sources are eliminated as much as possible, and continue sealing and eliminating hiding places. It may be necessary to move bait stations to other locations, use more stations, or apply additional dabs of bait if gel baits are being used.

When cockroach populations are under control, continue monitoring with traps on a regular basis to make sure reinfestation is not taking place. Maintain sanitation and exclusion techniques to avoid encouraging a new infestation. If severe reinfestations of household cockroaches continue to recur, consider that they may be coming in with items such as cardboard boxes. If you suspect cockroaches enter with groceries brought into the home, stop patronizing that market. Frequently they will enter from neighboring apartments if you live in a multiple family dwelling. Call the number listed on the front cover for information on reporting a cockroach infestation in your apartment complex.

When using any type of pesticide, always follow label directions carefully.